

A QUANTITATIVE STUDY OF THE VEGETATION SURROUNDING
POPULATIONS OF *ZIGADENUS DENSUS* (MELIANTHIACEAE)
AT FORT POLK IN WEST CENTRAL LOUISIANA, U.S.A.

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ABSTRACT

Osceola's plume (*Zigadenus densus* (Desr.) Fern) is a rare species (S2) in Louisiana with reports from Natchitoches, St. Tammany, Vernon, and Washington parishes. Quantitative data from 40 populations (clumps) are reported, and the plant community associated with *Z. densus* is described. In west central Louisiana, *Z. densus* is found along the natural levee of baygall streams and is associated with the tree species: *Magnolia virginiana*, *Pinus palustris*, and *Nyssa biflora*; the shrub species *Morella caroliniensis*, *Rhododendron oblongifolium*, and *Acer rubrum*; the woody vine species *Rubus argutus*, *Gelsemium sempervirens*, and *Smilax laurifolia*; and the herbaceous species *Dichanthelium dichotomum* var. *tenue*, *Eupatorium rotundifolium*, and *Osmunda regalis*.

RESUMEN

Zigadenus densus (Desr.) Fern es una especie rara (S2) en Luisiana con citas en la parroquias de Natchitoches, St. Tammany, Vernon, y Washington. Se citan datos cuantitativos de 40 poblaciones (matas), y se describe la comunidad vegetal asociada con *Z. densus*. En el centro oeste de Luisiana, *Z. densus* se encuentra a lo largo de las riveras naturales de torrentes y está asociado con tres especies: *Magnolia virginiana*, *Pinus palustris*, y *Nyssa biflora*; las especies arbustivas *Morella caroliniensis*, *Rhododendron oblongifolium*, y *Acer rubrum*; Las especies trepadoras *Rubus argutus*, *Gelsemium sempervirens*, y *Smilax laurifolia*; y las especies herbáceas *Dichanthelium dichotomum* var. *tenue*, *Eupatorium rotundifolium*, y *Osmunda regalis*.

INTRODUCTION

Osceola's Plume (*Zigadenus densus* (Desr.) Fern) is a rhizomatous herbaceous perennial, 4 to 20 dm in height with a distinct blue-green foliage color, flowering from March to July. Other common names include black snakeroot, death camasa, and crow poison. It is reported from Alabama, Delaware, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia (USDA NRCS 2013; Nature Serve 2013). In *Flora of North America North of Mexico* (Schwartz 2003), it is also reported from Kentucky, New Jersey, New York, and West Virginia. Globally, Osceola's plume is ranked G5, but it can be rare in certain parts of its range; it is ranked S1 in VA, S2 in LA, S3S4 in GA, and S4 in NC (Nature Serve 2013). In Louisiana, this S2 species is found in Natchitoches, St. Tammany, Vernon, and Washington parishes (Louisiana Natural Heritage Program 2011; MacRoberts et al. 2002; Thomas & Allen 1993). In Texas, *Z. densus* is reported from Anderson, Henderson, and Tyler counties (Diggs et al. 2006).

This species is reported from hillside bogs and longleaf flatwoods savannahs in Louisiana (Louisiana Natural Heritage Program 2011) and from wet areas, damp pinelands, and bogs in east Texas (Diggs et al. 2006). The habitats reported for this species in the *Flora of North America* are pine bogs and flatlands (Schwartz 2003). In the Carolinas, it is reported from savannahs and pocosins (Radford et al. 1968) and Godfrey and Wooten (1979) report it from pine savannahs, flatwoods, and bogs.

The objectives of this study were to document the species associated with *Z. densus* and to describe its habitat in west central Louisiana. Several populations of *Z. densus* are known from Fort Polk in Vernon Parish, west central Louisiana.

METHODS

In May to mid-June 2013, 40 populations (clumps) of *Z. densus* were surveyed on Fort Polk; most populations (clumps) had previously been found during vegetation surveys. Most (23) of the 40 sampling sites were located on Ruston fine sandy loam, others were found on Osier loamy fine sand (5/40), Malbis fine sandy loam (4/40), Eastwood silt loam (4/40), Betis loamy fine sand (2/40), and Guyton-luka complex (2/40) (Soil Survey Division 2003). The area around each population was examined and the 5 nearest individuals were identified and recorded for each of 5 categories including herbaceous, woody vine, shrub (woody non-vines shorter than 1.83 m), shrub/sapling (woody non-vines taller than 1.83 m and dbh less than 5 in), and tree (woody non-vines taller than 1.83 m and dbh larger than 5 in). The total number of individuals recorded for each plant category was 200 (40 populations and 5 individuals per population). The relative abundance was calculated by dividing the number of times a species was recorded by 200, the total number of observations. This was done for all 5 categories and converted to a percent (Allen et al. 2006).

During the same survey, we also recorded the presence of all herbaceous species within 1 m of the center of the *Z. densus* population. We didn't record the sizes of the clumps, but we approximate the average size of the clumps was about one square meter, with each clump having on average ten to fifteen stems. All woody vine and all shrub species within 4 m of the center were recorded. All tree or shrub/sapling species within 15 m of the center were recorded. The relative frequency was calculated by dividing the number of occurrences for a species by the total number of occurrences recorded for the category. This value was converted to a percent.

Importance value (total = 200) for herbaceous, woody vines, and shrubs was calculated by adding the relative frequency and the relative abundance (Megyeri & Allen 2011). Importance value (total = 300) for trees/shrub saplings was calculated by adding the relative abundance for each species in the shrub/sapling category and tree category to the relative frequency of each species in the tree/shrub/sapling category.

RESULTS AND DISCUSSION

A total of 168 species were recorded including 81 herbaceous, 12 woody vines, and 75 woody non-vines (39 shrubs and 36 trees; note overlap in categories). The species are listed by decreasing importance value. The most important herbaceous species were *Dichanthelium tenue* (27.74), *Eupatorium rotundifolium* (14.74), and *Osmunda regalis* (13.55) (Table 1). The woody vine species with the highest importance value were *Rubus argutus* (52.38), *Gelsemium sempervirens* (32.62), and *Smilax laurifolia* (32.42) (Table 2). The most important shrub species were *Morella caroliniensis* (22.12), *Rhododendron oblongifolium* (20.29), and *Acer rubrum* (19.44) (Table 3). The shrub/sapling and tree species with the highest importance value were *Magnolia virginiana* (54.39) and *Pinus palustris* (53.53) (Table 4).

The *Zigadenus densus* habitat in west central Louisiana is best described as the natural levee and seepage areas upslope of baygall streams with the vegetation being typical of such a stream. We found the tree canopy vegetation associated with *Z. densus* to be *Magnolia virginiana*, *Pinus palustris*, *Nyssa biflora*, and *Acer rubrum* var. *drummondii* and the shrub canopy to be *Morella caroliniensis*, *Rhododendron oblongifolium*, and *Acer rubrum*. These woody species are similar to the species reported for baygalls in the area (Allen et al. 2004), in east Texas (Diggs et al. 2006), and in central Louisiana (MacRoberts et al. 2004).

Allen et al. (2013) and MacRoberts et al. (2004) report two (*Magnolia virginiana* and *Nyssa biflora*) of the top three tree/shrub species in importance value to be the same as in our study. Our study shares 10 of the top 20 species of shrub/saplings with Allen et al. (2013)'s study of yellow root. Allen et al. (2013) shares 8 of the 12 woody vine species with our study, but the 3 most important woody vines in association with *Z. densus* are the 3 least important woody vines in association with yellow root. Allen et al. (2013) has 6 of the top 15 herbaceous species in common with our study of *Z. densus* in their yellow root study.

Our data are the first quantitative report on the vegetation surrounding *Zigadenus densus*. The vegetation around the other populations of *Zigadenus densus* throughout its range should be sampled for comparison with our data so as to get a better idea of the variation, if any, of its habitat.

TABLE 1. Relative abundance, relative frequency, and importance value for herbaceous species recorded from 40 *Zigadenus densus* sites at Fort Polk in west central Louisiana.

Species	Relative Abundance	Relative Frequency	Importance Value
<i>Dichanthelium dichotomum</i> (L.) Gould var. <i>tenu</i> e (Muhl.) Gould & C.A. Clark	19.50	8.24	27.74
<i>Eupatorium rotundifolium</i> L.	6.50	8.24	14.74
<i>Osmunda regalis</i> L.	9.00	4.55	13.55
<i>Scleria</i> spp.	7.50	3.69	11.19
<i>Mitchella repens</i> L.	5.00	3.41	8.41
<i>Dichanthelium scabriusculum</i> (Ell.) Gould & C.A. Clark	5.00	2.84	7.84
<i>Osmunda cinnamomea</i> L.	3.50	4.26	7.76
<i>Symphyotrichum lateriflorum</i> (L.) A.& D. Löve	2.50	4.26	6.76
<i>Woodwardia virginica</i> (L.) Sm.	4.00	2.27	6.27
<i>Viola</i> × <i>primulifolia</i> L. (pro sp.)	1.00	4.26	5.26
<i>Solidago rugosa</i> P. Mill.	3.00	1.70	4.70
<i>Solidago patula</i> Muhl. ex Willd.	1.50	3.13	4.63
<i>Doellingeria sericocaroides</i> Small	2.50	1.99	4.49
<i>Coreopsis tripteris</i> L.	2.00	2.27	4.27
<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark var. <i>acuminatum</i>	2.50	1.14	3.64
<i>Woodwardia areolata</i> (L.) T. Moore	2.50	1.14	3.64
<i>Sarracenia alata</i> Wood.	1.50	1.99	3.49
<i>Rhexia alifanus</i> Walt.	2.50	0.85	3.35
<i>Centella erecta</i> (L. f.) Fern.	1.50	1.70	3.20
<i>Oxypolis rigidior</i> (L.) Raf.	0.50	2.56	3.06
<i>Chasmanthium laxum</i> (L.) Yates	1.00	1.99	2.99
<i>Pteridium aquilinum</i> (L.) Kuhn	1.50	1.42	2.92
<i>Carex lonchocarpa</i> Willd.	2.00	0.57	2.57
<i>Helianthus angustifolius</i> L.	1.00	1.42	2.42
<i>Schizachyrium scoparium</i> (Michx.) Nash	1.00	1.42	2.42
<i>Dichanthelium dichotomum</i> (L.) Gould var. <i>dichotomum</i>	0.50	1.70	2.20
<i>Scleria pauciflora</i> Muhl. ex Willd.	1.00	1.14	2.14
<i>Carex glaucescens</i> Ell.	0.50	1.42	1.92
<i>Eupatorium leucolepis</i> (DC.) Torr. & A. Gray	0.50	1.42	1.92
<i>Melanthium virginicum</i> L.	1.00	0.85	1.85
<i>Panicum virgatum</i> L.	1.00	0.85	1.85
<i>Eupatorium fistulosum</i> Barratt	0.50	1.14	1.64
<i>Rudbeckia scabrifolia</i> L.E. Brown	1.00	0.57	1.57
<i>Lobelia puberula</i> Michx. var. <i>puberula</i>	0.00	1.42	1.42
<i>Mitreola sessilifolia</i> (J.F. Gmel.) G. Don	0.00	1.14	1.14
<i>Elephantopus nudatus</i> A. Gray	0.50	0.57	1.07
<i>Eupatorium perfoliatum</i> L.	0.50	0.57	1.07
<i>Gentiana saponaria</i> L.	0.50	0.57	1.07
<i>Ptilimnium costatum</i> (Ell.) Raf.	0.50	0.57	1.07
<i>Scutellaria integrifolia</i> L.	0.00	0.85	0.85
<i>Xyris</i> spp.	0.00	0.85	0.85
<i>Ambrosia psilostachya</i> DC.	0.50	0.28	0.78
<i>Dichanthelium laxiflorum</i> (Lam.) Gould	0.50	0.28	0.78
<i>Paspalum</i> spp.	0.50	0.28	0.78
<i>Scleria oligantha</i> Michx.	0.50	0.28	0.78
<i>Ambrosia artemisiifolia</i> L.	0.00	0.57	0.57
<i>Athyrium filix-femina</i> (L.) Roth	0.00	0.57	0.57
<i>Ctenium aromaticum</i> (Walt.) Wood	0.00	0.57	0.57
<i>Dichanthelium sphaerocarpon</i> (Ell.) Gould	0.00	0.57	0.57
<i>Oldenlandia uniflora</i> L.	0.00	0.57	0.57
<i>Rhexia petiolata</i> Walt.	0.00	0.57	0.57
<i>Rhynchospora</i> spp.	0.00	0.57	0.57
<i>Aristida purpurascens</i> Poir. var. <i>purpurascens</i>	0.00	0.28	0.28
<i>Asclepias rubra</i> L.	0.00	0.28	0.28
<i>Calopogon tuberosus</i> (L.) B.S.P.	0.00	0.28	0.28
<i>Centrosema virginianum</i> (L.) Benth.	0.00	0.28	0.28
<i>Chamaecrista fasciculata</i> (Michx.) Greene	0.00	0.28	0.28
<i>Chaptalia tomentosa</i> Vent.	0.00	0.28	0.28

TABLE 1. continued

Species	Relative Abundance	Relative Frequency	Importance Value
<i>Coreopsis gladiata</i> Walt.	0.00	0.28	0.28
<i>Dichantheium aciculare</i> (Desv. ex Poir.) Gould & C.A. Clark	0.00	0.28	0.28
<i>Dichantheium commutatum</i> (J.A. Schultes) Gould	0.00	0.28	0.28
<i>Dichantheium polyanthes</i> Schult	0.00	0.28	0.28
<i>Eryngium integrifolium</i> Walt.	0.00	0.28	0.28
<i>Euphorbia corollata</i> L.	0.00	0.28	0.28
<i>Galactia volubilis</i> (L.) Britt.	0.00	0.28	0.28
<i>Liatris spicata</i> (L.) Willd.	0.00	0.28	0.28
<i>Linum medium</i> (Planch.) Britt. var. <i>texanum</i> (Planch.) Fern.	0.00	0.28	0.28
<i>Ludwigia glandulosa</i> Walt.	0.00	0.28	0.28
<i>Ludwigia hirtella</i> Raf.	0.00	0.28	0.28
<i>Lycopodiella caroliniana</i> (L.) Pichi Sermolli	0.00	0.28	0.28
<i>Lycopus rubellus</i> Moench	0.00	0.28	0.28
<i>Muhlenbergia capillaris</i> (Lam.) Trin.	0.00	0.28	0.28
<i>Oligoneuron nitidum</i> (Torr. & A. Gray) Small	0.00	0.28	0.28
<i>Plantanthera</i> spp.	0.00	0.28	0.28
<i>Pluchea rosea</i> Godfrey	0.00	0.28	0.28
<i>Rhexia mariana</i> L.	0.00	0.28	0.28
<i>Rhynchosia latifolia</i> Nutt. ex Torr. & A. Gray	0.00	0.28	0.28
<i>Solidago odora</i> Ait.	0.00	0.28	0.28
<i>Tephrosia onobrychoides</i> Nutt.	0.00	0.28	0.28
<i>Vernonia texana</i> (A. Gray) Small	0.00	0.28	0.28
Total	100.00	100.00	200.00

TABLE 2. Relative abundance, relative frequency, and importance value for woody vine species recorded from 40 *Zigadenus densus* sites at Fort Polk in west central Louisiana.

Species	Relative Abundance	Relative Frequency	Importance Value
<i>Rubus argutus</i> Link	33.67	18.71	52.38
<i>Gelsemium sempervirens</i> (L.) St. Hil.	20.92	11.70	32.62
<i>Smilax laurifolia</i> L.	14.29	18.13	32.42
<i>Toxicodendron radicans</i> (L.) Kuntze	8.67	11.11	19.78
<i>Bignonia capreolata</i> L.	7.65	11.11	18.76
<i>Smilax glauca</i> Walt.	6.63	9.36	15.99
<i>Smilax rotundifolia</i> L.	3.06	8.19	11.25
<i>Vitis rotundifolia</i> Michx.	1.53	5.26	6.79
<i>Smilax smallii</i> Morong	3.06	2.92	5.98
<i>Smilax walteri</i> Pursh	0.00	2.34	2.34
<i>Parthenocissus quinquefolia</i> (L.) Planch.	0.51	0.58	1.09
<i>Berchemia scandens</i> (Hill) K. Koch	0.00	0.58	0.58
Total	100.00	100.00	200.00

TABLE 3. Relative abundance, relative frequency, and importance value for shrub/sapling (< 1.83 m) species recorded from 40 *Zigadenus densus* sites at Fort Polk in west central Louisiana.

Species	Relative Abundance	Relative Frequency	Importance Value
<i>Coreopsis gladiata</i> Walt.	0.00	0.28	0.28
<i>Morella caroliniensis</i> (P. Mill.) Small	16.00	6.12	22.12
<i>Rhododendron oblongifolium</i> (Small) Millais	16.00	4.29	20.29
<i>Acer rubrum</i> L. var. <i>drummondii</i> (Hook. & Arn. ex Nutt.) Sarg.	12.50	6.94	19.44
<i>Photinia pyrifolia</i> (Lam.) Robertson & Phipps	10.00	5.51	15.51
<i>Persea palustris</i> (Raf.) Sarg.	8.00	5.71	13.71
<i>Hypericum crux-andreae</i> (L.) Crantz	4.00	4.08	8.08
<i>Alnus serrulata</i> (Ait.) Willd.	3.50	4.49	7.99
<i>Magnolia virginiana</i> L.	2.00	5.71	7.71
<i>Ilex coriacea</i> (Pursh) Chapman	3.00	4.69	7.69
<i>Toxicodendron vernix</i> (L.) Kuntze	1.50	5.31	6.81
<i>Morella cerifera</i> (L.) Small	3.00	3.06	6.06
<i>Nyssa biflora</i> Walt.	3.00	2.86	5.86
<i>Vaccinium elliotii</i> Chapman	2.00	3.67	5.67
<i>Vaccinium fuscatum</i> Ait.	0.50	4.69	5.19
<i>Viburnum nudum</i> L. var. <i>nudum</i>	0.50	4.29	4.79
<i>Hypericum hypericoides</i> (L.) Crantz ssp. <i>hypericoides</i>	2.50	2.04	4.54
<i>Itea virginica</i> L.	2.50	2.04	4.54
<i>Callicarpa Americana</i> L.	0.50	3.47	3.97
<i>Liquidambar styraciflua</i> L.	1.50	2.04	3.54
<i>Pinus taeda</i> L.	1.50	1.84	3.34
<i>Lyonia lucida</i> (Lam.) K. Koch	1.00	1.63	2.63
<i>Rhododendron canescens</i> (Michx.) Sweet	1.00	1.63	2.63
<i>Viburnum nudum</i> L. var. <i>cassinoides</i> (L.) Torr. & A. Gray	0.50	1.84	2.34
<i>Rhus copallinum</i> L.	1.00	1.22	2.22
<i>Ilex opaca</i> Ait.	0.50	1.43	1.93
<i>Hypericum galioides</i> Lam.	0.50	1.22	1.72
<i>Quercus laurifolia</i> Michx.	0.50	1.22	1.72
<i>Quercus falcata</i> Michx.	0.50	1.02	1.52
<i>Chionanthus virginicus</i> L.	0.00	1.22	1.22
<i>Symplocos tinctoria</i> (L.) L'Hér.	0.00	1.02	1.02
<i>Ilex vomitoria</i> Ait.	0.00	0.82	0.82
<i>Sassafras albidum</i> (Nutt.) Nees	0.00	0.82	0.82
<i>Hypericum frondosum</i> Michx.	0.50	0.20	0.70
<i>Quercus alba</i> L.	0.00	0.61	0.61
<i>Pinus palustris</i> P. Mill.	0.00	0.41	0.41
<i>Quercus hemisphaerica</i> Bartr. ex Willd. var. <i>hemisphaerica</i>	0.00	0.20	0.20
<i>Quercus nigra</i> L.	0.00	0.20	0.20
<i>Vaccinium arboreum</i> Marsh.	0.00	0.20	0.20
<i>Vaccinium virgatum</i> Ait.	0.00	0.20	0.20
Total	100.00	100.00	200.00

TABLE 4. Relative abundance, relative frequency, and importance value for tree/shrub/sapling (> 1.83 m) species recorded from 40 *Zigadenus densus* sites at Fort Polk in west central Louisiana.

Species	<5" dbh	>5"dbh	Relative Frequency	Importance Value
	Relative Abundance	Relative Abundance		
<i>Magnolia virginiana</i> L.	23.50	20.00	10.89	54.39
<i>Pinus palustris</i> P. Mill.	7.00	36.50	10.03	53.53
<i>Nyssa biflora</i> Walt.	7.50	25.00	10.32	42.82
<i>Acer rubrum</i> L. var. <i>drummondii</i> (Hook. & Arn. ex Nutt.) Sarg	19.50	5.00	10.32	34.82
<i>Persea palustris</i> (Raf.) Sarg.	17.50	2.50	8.02	28.02
<i>Ilex coriacea</i> (Pursh) Chapman	8.50	0.00	5.44	13.94
<i>Pinus taeda</i> L.	1.50	6.50	4.58	12.58
<i>Liquidambar styraciflua</i> L.	2.50	3.00	4.58	10.08
<i>Toxicodendron vernix</i> (L.) Kuntze	4.00	0.00	4.87	8.87
<i>Ilex opaca</i> Ait.	0.00	1.00	4.01	5.01
<i>Alnus serrulata</i> (Ait.) Willd.	1.00	0.00	3.72	4.72
<i>Viburnum nudum</i> L. var. <i>nudum</i>	1.50	0.00	2.29	3.79
<i>Morella caroliniensis</i> (P. Mill.) Small	0.50	0.00	2.29	2.79
<i>Callicarpa americana</i> L.	1.00	0.00	1.72	2.72
<i>Quercus laurifolia</i> Michx.	0.00	0.00	2.58	2.58
<i>Symplocos tinctoria</i> (L.) L'Hér.	1.50	0.00	0.57	2.07
<i>Morella cerifera</i> (L.) Small	0.50	0.00	1.43	1.93
<i>Vaccinium fuscatum</i> Ait.	0.50	0.00	1.43	1.93
<i>Ilex vomitoria</i> Ait.	0.50	0.00	1.15	1.65
<i>Quercus falcate</i> Michx.	0.00	0.50	1.15	1.65
<i>Quercus alba</i> L.	0.00	0.00	1.43	1.43
<i>Vaccinium elliotii</i> Chapman	0.50	0.00	0.86	1.36
<i>Lyonia lucida</i> (Lam.) K. Koch	0.00	0.00	1.15	1.15
<i>Photinia pyrifolia</i> (Lam.) Robertson & Phipps	0.50	0.00	0.57	1.07
<i>Viburnum nudum</i> L. var. <i>cassinoides</i> (L.) Torr. & A. Gray	0.50	0.00	0.57	1.07
<i>Rhododendron canescens</i> (Michx.) Sweet	0.00	0.00	0.86	0.86
<i>Castanea pumila</i> (L.) P. Mill. var. <i>pumila</i>	0.00	0.00	0.57	0.57
<i>Chionanthus virginicus</i> L.	0.00	0.00	0.29	0.29
<i>Itea virginica</i> L.	0.00	0.00	0.29	0.29
<i>Pinus echinata</i> P. Mill.	0.00	0.00	0.29	0.29
<i>Prunus serotina</i> Ehrh.	0.00	0.00	0.29	0.29
<i>Quercus hemisphaerica</i> Bartr. ex Willd. var. <i>hemisphaerica</i>	0.00	0.00	0.29	0.29
<i>Quercus incana</i> Bartr.	0.00	0.00	0.29	0.29
<i>Quercus marilandica</i> Muenchh.	0.00	0.00	0.29	0.29
<i>Quercus nigra</i> L.	0.00	0.00	0.29	0.29
<i>Vaccinium arboreum</i> Marsh.	0.00	0.00	0.29	0.29
Total	100.00	100.00	100.00	300.00

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